

Remarks

Applicant has amended claims 1 and 10. Applicant respectfully submits that no new matter was added by the amendment, as all of the amended matter was either previously illustrated or described in the drawings, written specification and/or claims of the present application. Entry of the amendment and favorable consideration thereof is earnestly requested.

The Examiner has rejected claims 1-18 and 35 under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. The Examiner has further rejected claims 1-18 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,128,083 to Brooks et al. ("the '083 patent"), in view of U.S. Patent No. 3,573,023 to Thomas et al. ("the '023 patent"), U.S. Patent No. 6,153,023 to Rokutanda et al. ("the '023 patent"), and the Abstract of JP 04108675. The Examiner has still further submitted that claims 1-18 are rejected under 35 U.S.C. §103(a) as being unpatentable over the '083 patent, the '023 patent, or the Abstract of JP 04108675 in view of U.S. Patent No. 5,228,245 to Rice et al. ("the '245 patent"). These rejections are respectfully traversed.

35 U.S.C. §112, First Paragraph Rejections

The Examiner discussed eight factors in determining whether there is sufficient evidence to support a determination that the disclosure does not satisfy the enablement requirement including:

- (A) the breadth of the claims;
- (B) the nature of the invention;
- (C) the state of the prior art;
- (D) the level of one of ordinary skill;
- (E) the level of predictability in the art;
- (F) the amount of direction provided by the inventor;
- (G) the existence of working examples; and
- (H) the quantity of experimentation needed to make or use the invention based on the content of the disclosure.

Applicant will present arguments in response to the points submitted by the Examiner in the Official Action dated 10/28/04.

(A) As amended, all the claims of the present invention are limited to a workpiece consisting of ceramic. While the Examiner has submitted that the types of man-made materials generally include "metals, plastics and ceramics" and that "the claims encompass a massive genus of materials" (Official Action 10/28/04, p. 3), Applicant respectfully submits that as amended, the claims are limited to workpieces made solely of ceramic (such as silicon nitrides) and do not cover various composite materials as suggested by the Examiner, such as cermets or cemented carbides. See Specification paragraphs 4, 25, and 31. The Examiner has further submitted that he "does not agree with applicant's position that the claims are limited to "true ceramics" (whatever that would mean)." (Official Action 10/28/04, p. 3). As amended, all the claims are limited to workpieces consisting of ceramic, and as stated in Applicant's declaration, the term "ceramic" "does not include non or near ceramic materials compositions such as for instance, cermets and cemented carbides." (Declaration of Mr. Hans Wulf Pfeiffer dated 3/9/04). Applicant respectfully submits that the terms "true ceramics" and "near ceramics" are terms used in the art and are understood by those of ordinary skill in the art. For example, these terms are used in the '023 patent where, in differentiating "ceramics" from "near ceramics" the '023 patent teaches that "we suggest these – materials comprising tungsten carbide, boron carbide, aluminum oxide, or magnesium oxide – to encompass both the near ceramics and the true ceramics." (col. 3, lines 52-55). The '023 patent further teaches that "the type of material undertaken for treatment will dictate use of either the basic method of our invention, or the temperature-controlled method of our invention. For the mechanical deformation of materials comprising tungsten carbide can be carried out at normal room temperatures. Materials comprising aluminum oxide, however, require surface deformation in an elevated-temperature environment." (col. 3, lines 58-65). Further clarifying the difference between near ceramics and true ceramics, the '023 patent itemizes workpieces as follows: "cemented

carbides, e.g., tungsten carbide, or boron carbide", and true ceramics "those comprising aluminum oxides, or magnesium oxides."(col. 1, lines 43-45). Applicant therefore respectfully submits that the differentiation of "near ceramics" from "true ceramics" as used in Applicant's declaration are terms of art well known and used in the industry by those of ordinary skill in the art as evidenced in the '023 patent and that as amended, the present claims are not so broad as to cover any workpiece that is not a metal or plastic.

(B) The Examiner has stated that the nature of the invention does not lend itself as evidence to show the invention is enabled. (Official Action 10/28/04, p. 3). Applicant notes that in the detailed description specifics relating to the method as claimed are discussed including the results from experimentation (i.e. par. 25, "an increase of the boundary layer strength of 15% could be achieved"; par. 27, "plastic deformation is restricted to a predetermined laterally narrowly limited surface area"; par. 27, "the tool . . . must be rated as non-sharp-edged"; par. 29, "critical values for the sphere diameter range from about .1 mm to a maximum of 4 mm"; par. 31, "For determining process parameters required for successful operation preferably two preliminary experiments must be performed: on a plate of the material to be treated the dependence of the compression yielding point and brittle fracture limit on the tool geometry is determined. To this end the static ball thrust test is employed, for instance, which is described e.g. in the article by T. hollstein et al. "Vollkeramische Baelzlager aus Siliziumnitrit: Anwendun, Auslegung und Optimierung" [Fully ceramic rolling bearings made of silicon nitrite: application, designing and optimization], in: VDI-Reports no. 1151, 1995, pages 3 to 10." ("the static ball thrust article"); par. 31, "A material having at least the same hardness as the workpiece to be treated is selected as tool material" and that the "preliminary experiment furnishes the required tool geometry and the admissible amount of momentum to be introduced."). Applicant respectfully submits that all steps and requirements as claims are clearly described so as to show the invention is enabled.

(C) The Examiner has submitted that the state of the art is that applicant's invention cannot be done. Applicant agrees with the Examiner that the prior art has failed to achieve the desired result of increasing the boundary layer strength of workpieces made solely of ceramic without first increasing the temperature of the workpiece substantially above room temperature. Applicant notes however, that the fact that others have not been able to solve this long standing and vexing problem in the industry is not evidence that Applicant method disclosed and taught in the specification does not achieve the results described therein. Rather, those of skill in the art upon following the process steps outlined and detailed in the specification will be taught how to increase the boundary layer strength by as much as 15% of a workpiece consisting of ceramic without elevating the workpiece above room temperature.

(F) The Examiner has submitted that the "amount of direction provided by the inventor is low" and that there "is no indication or suggestion as to what ceramics might work or what amount of force is needed to get the strengthening effect." (Official Action 10/28/04 p. 5). Applicant respectfully disagrees. As stated above in sections (A) and (B), the material of the workpiece is limited to a ceramic and does not include composite materials such as cermets and cemented carbides. In addition, the specification teaches that a "static ball thrust test" is to be employed, referencing the article by T. hollstein et al. "Vollkeramische Baelzlager aus Siliziumnitrit: Anwendun, Auslegung und Optimierung" [Fully ceramic rolling bearings made of silicon nitrite: application, designing and optimization], in: VDI-Reports no. 1151, 1995, pages 3 to 10, which is incorporated by reference, which fully outlines and details for performing a "static ball thrust test." This specification further details how the static ball thrust test is to be performed to achieve the desired strengthening results as previously referenced above.

(H) The Examiner has further submitted that the "prior art indicates the invention would not work." (See response to (C) above).

Applicant respectfully submits that static ball thrust tests as taught in the static ball thrust article from 1995 are well known in the art, however, the novel combination of the specific steps taught in the specification provide the "unforeseen finding that an increase of the boundary layer strength by mechanical treatment on the surface is possible on brittle, hard materials, without the necessity of elevating the temperature of the brittle, hard material." (par. 25). Accordingly, Applicant respectfully submits that the specification does enable one of ordinary skill in the art to practice and achieve the results disclosed in the specification without undue experimentation.

35 U.S.C. §103(a) Rejections

As amended, all claims of the present invention requires among other steps: providing a workpiece consisting of ceramic, the temperature of which is not elevated above room temperature and which does not comprise zirconia, providing a tool having a diameter that does not exceed a range from about .1 mm to about 4 mm and is at least the same order of hardness as the ceramic workpiece, contacting the ceramic workpiece with the tool within a predetermined surface area, generating internal compressive strain within the ceramic workpiece in the vicinity of the predetermined surface area where generation of damage in the form of brittle fracture processes in the predetermined surface area is substantially avoided and the boundary layer strength of the ceramic workpiece is increased

The Examiner has submitted that the "broadest interpretation of the term "ceramic workpiece" would be: a workpiece which comprises at least one ceramic material." (Official Action 10/28/04, p. 6). Applicant respectfully submits that as amended all claims require a workpiece consisting of ceramic and therefore the workpiece of manufacture may not comprise other materials such as metal as taught in the '023 patent.

Applicant further respectfully submits that the Examiner has stated that the "state of the prior art is that applicant's invention cannot be done." (Official Action 10/28/04, p. 3). Applicant agrees that the cited combinations of prior art fail to teach, disclose or suggest that the boundary layer strength of a workpiece consisting of ceramic may be increased by impacting the workpiece with a tool without elevating the temperature of the workpiece substantially above room temperature. Applicant therefore respectfully submits that none of the above cited references can render the present claims obvious. In fact, the numerous articles identifying this problem and the long standing need in the industry are further evidence that the novel combination of steps taught and disclosed in the specification and required by all the claims cannot be obvious in view of the prior art.

Still further, as previously submitted in Applicant's Response dated March 22, 2004, none of the above cited prior art teaches that a boundary layer strength of a workpiece consisting of ceramic may be increased by impacting the workpiece with a tool without elevating the temperature of the workpiece substantially above room temperature. Therefore, none of the above cited prior art can render the present claims obvious.

It is respectfully submitted that claims 1-18, all of the claims remaining in the application, are in order for allowance and early notice to that effect is respectfully requested.

Respectfully submitted,



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